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A NEW CRAYFISH OF THE GENUS CAMBARUS FROM TEXAS, WITH NOTES ON THE DISTRIBUTION OF CAMBARUS FODIENS (COTTLE)

By Horton H. Hobbs, Jr.

The new crayfish herein described is a member of the Diogenes section, a rather advanced assemblage of species belonging to the genus *Cambarus*. The Diogenes section is defined by Ortmann (1931, p. 146) as follows: "Carapace ovate, compressed, and without lateral spines. Rostrum without marginal spines. Chelae short, ovate, broad, and depressed. Areola very narrow or obliterated (linear) in the middle, always distinctly longer than one third of the carapace. Eyes well developed."

Specimens of this undescribed species have been previously collected and identified as *Cambarus argillicola* Faxon [=*C. fodiens* (Cottle, 1863, p. 217)], and while there are a number of references to it in the literature, most of them are repetitions of a few locality records. The synonymy listed below is as nearly complete as I have been able to ascertain.

My interest in the problem of the distribution of *C. fodiens* was aroused several months ago when Joel W. Hedgpeth, of the Institute of Marine Science, Port Aransas, Tex., sent two crayfishes from the Aransas Refuge to the United States National Museum for determination. Upon comparing these crayfishes with specimens of *C. fodiens* it was found that they belonged to an undescribed species. In order to determine the range of this new form it was necessary to attempt to clarify a few of the questions that had arisen in the literature as to the range of *C. fodiens* and my conclusions are presented at the end of this paper.

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I wish to express my appreciation to Mr. Hedgpeth, in whose honor this species is named, for obtaining additional specimens for me. I also wish to thank Dr. Waldo L. Schmitt and Dr. Fenner A. Chace, Jr., both of the United States National Museum, for their kindness in making the Museum collection accessible and for checking the manuscript of this paper.

Genus CAMBARUS Erichson, 1846

CAMBARUS HEDGPETHI, new species

FIGURE 17

Cambarus argillicola FAXON, 1884, p. 116, in part, p. 144, in part; 1885, p. 77, in part; 1898, p. 650, in part; 1914, p. 400, in part.—HARRIS, 1903, p. 59, in part, p. 71, in part, p. 137, in part, p. 158, in part, pp. 144, 150, 153, in part, pl. 3, in part.—HAY, 1899, p. 959, in part.—(?) LYLE, 1938, p. 76.—ORTMANN, 1902, p. 280; 1905, p. 123, in part, p. 136, in part.—TURNER, 1926, p. 187, in part).

Cambarus fodiens CREASER, 1931, p. 269, in part; 1932, p. 336, in part.—PENN, 1941, p. 8.

Diagnosis.—Rostrum without lateral spines; areola obliterated in middle; chela strongly depressed with a prominent tuft of plumose setae along base of opposable margin of immovable finger; mesial process of first pleopod of first-form male so grooved as to appear slightly twisted. It may be readily distinguished from its closest relatives, *C. byersi* Hobbs (1941, p. 118) and *C. fodiens*, as follows: In *C. byersi* there is no tuft of setae along the base of the opposable margin of immovable finger; however, there is a row of long setae along the outer lower surface of the hand which is not present in *C. hedgpethi.* In *C. fodiens* there is a single major tubercle on opposable margin of immovable finger, and in *C. hedgpethi* there are two major tubercles.

Holotypic male, form I.—Body subcylindrical. Abdomen narrower than thorax (11.1–13.4 mm. in widest parts, respectively).

Width of carapace slightly greater than depth in region of caudodorsal margin of cervical groove (13.1–12.9 mm.). Greatest width of carapace slightly caudad of caudodorsal margin of cervical groove (13.4 mm.).

Areola obliterated in middle; cephalic section of carapace about 1.5 times as long as areola (length of areola about 40 percent of entire length of carapace).

Rostrum directed cephaloventrad; upper surface deeply excavate cephalad; margins converge gently from base and turn somewhat abruptly mesiad at base of acumen; acumen not distinctly set off from rest of rostrum; no lateral spines present; tip of rostrum bears an acute upturned tubercle and extends to distal end of penultimate segment of peduncle of antennule. Sparsely punctate above at base and

with a row of setiferous punctations along inner margins of lateral ridges; rostral ridges not much inflated and extend cephalad to apex of rostrum. Subrostral ridges weak. Postorbital ridges low and terminate cephalad without a spine. Suborbital angle absent. Branchiostegal spines minute.

Surface of carapace punctate dorsad and slightly granulate laterad.

Abdomen slightly shorter than carapace (25.5–26.8 mm.).

Cephalic section of telson with one spine in the right and two in the left caudolateral corners.

Epistome with cephalolateral margins rounded. No cephalomedian projection.

Eyes normal.

Antennules of the usual form; a spine present on ventral side of basal segment.

Antennae broken (see description for morphotypic male). Antennal scale small (fig. 17, *i*); outer distal portion bearing a strong spine; lamellar portion comparatively broad, broadest distad of middle; inner margin rounded.

First left pereiopod (dactyl on right pereiopod broken) strongly depressed, palm slightly inflated. Fingers only slightly gaping with tip of dactyl passing beneath tip of propodus, when fingers are brought together, to a greater degree than in most crayfishes. Hand punctate above and below; mesial margin with a row of six or seven well-defined tubercles subtended dorsad by a weaker row of five tubercles. Outer margin of hand with a distinct ridge. One tubercle present along articulation of movable finger on lower surface of hand.

Opposable margin of dactyl of first left pereiopod with a single row of minute denticles along distal third, and a row of seven tubercles, third from base the largest, on proximal two-thirds. An excision occurs just proximad of the largest tubercle. A distinct submedian ridge flanked on either side by a row of setiferous punctations present on upper surface of dactyl. Mesial margin with a row of 10 tubercles along basal two-thirds and 5 setiferous punctations on distal third; a row of 5 smaller tubercles on proximal fourth immediately above the larger tubercles just mentioned. Lower surface of dactyl with a submedian ridge flanked proximally by a row of setiferous punctations on either side.

Opposable margin of immovable finger of first left pereiopod with a single row of minute denticles along distal third, and a row of five tubercles, the proximal two the largest on proximal two-thirds (in some specimens there is a small tubercle proximal to the more proximal large one); a distinct ridge present from base of finger to second large tubercle. Upper surface with a submedian ridge flanked on each side by a row of setiferous punctations with a number of very deep ones laterad of base. Lateral margin keeled with a row of setiferous

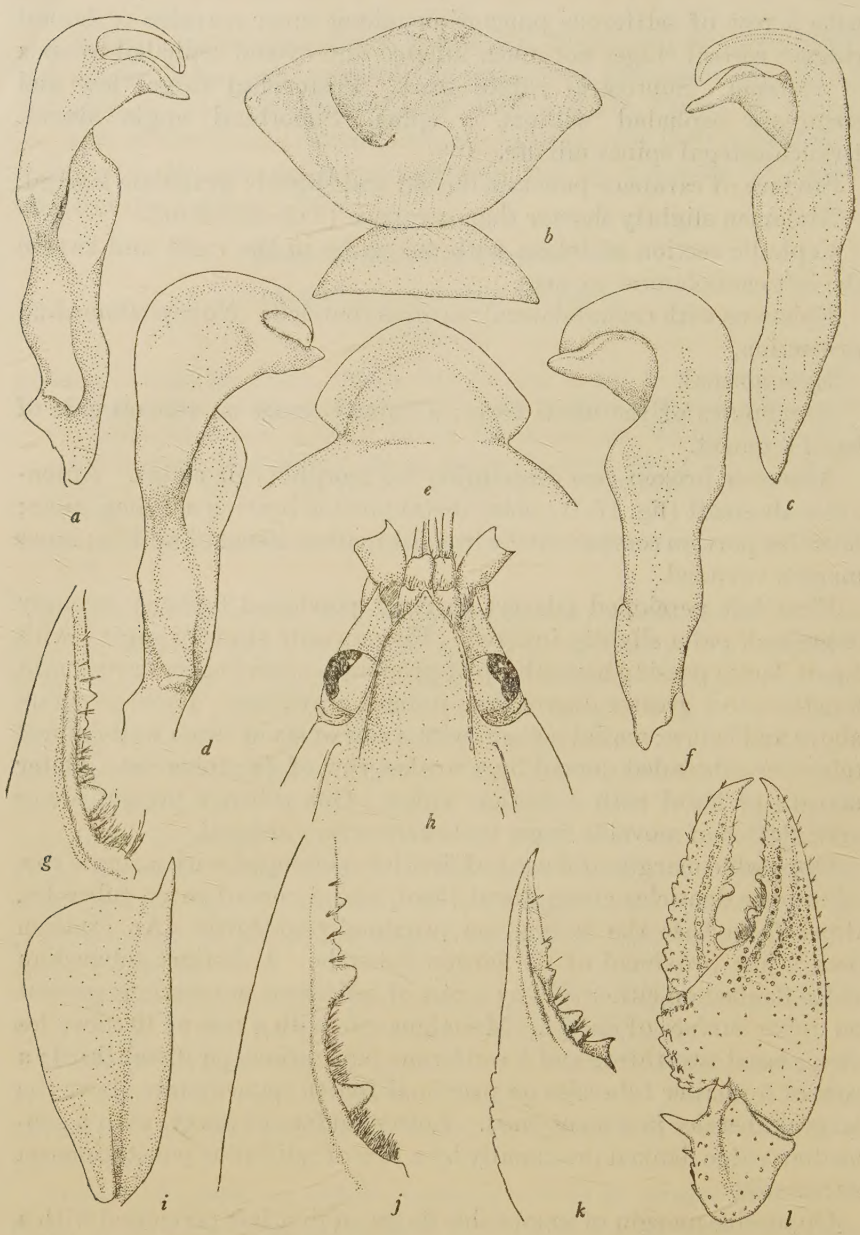

FIGURE 17.—*a–f, h–j, l, Cambarus hedgpethi: a,* Mesial view of first pleopod of first-form male; *b,* annulus ventralis; *c,* lateral view of first pleopod of first-form male; *d,* mesial view of first pleopod of second-form male; *e,* epistome; *f,* lateral view of first pleopod of second-form male; *h,* cephalic portion of carapace; *i,* antennal scale; *j,* upper surface of immovable finger; *l,* chela. *g, C. fodiens:* Upper surface of immovable finger of specimen from Washtenaw County, Mich. *k, C. byersi:* Upper surface of immovable finger of specimen from Escambia County, Fla.

punctations on either side of keel. Lower surface with a mesial keel, otherwise punctate; immediately mesiad and above the keel is a mat of plumose setae.

Carpus of first left pereiopod longer than wide, longer than inner margin of palm of chela; well-defined longitudinal furrow above. Lateral portion of upper surface and lateral surface punctate; mesial portion of upper surface with a group of nine small tubercles, below which is a row of four larger ones, the distal member of this row decidedly larger than the others and spikelike; lower mesial margin with five small tubercles and the lower cephalic margin with two large ones.

Merus of first left pereiopod sparsely punctate mesiad and laterad. Lower mesial margin with 13 tubercles, the penultimate the largest; lower lateral margin with five small ones. Upper margin of merus emarginate with two small tubercles slightly proximad of distal margin, and a transverse row of three small ones on distal margin.

Margins of maxillipeds and second pereiopods bearing long hairs.

Hooks present on ischiopodites of third pereiopods only; hooks slender.

First pleopod reaching to base of third pereiopods and terminating in two distinct parts. Central projection corneous and bladelike, recurved at slightly greater than a right angle to the main shaft; caudodistal margin entire. Mesial process grooved so as to appear twisted, not bulbous, and lies parallel to the central projection.

Allotypic female.—Differs from the holotype in the following respects: Cephalic section of telson with 2 spines in each caudolateral corner. Antennae extend caudad to third abdominal segment. Opposable margin of dactyl with 10 tubercles; however, third from base largest as in holotype. Row of tubercles on upper surface of dactyl above the mesial row consisting of 4 instead of 5. Opposable margin of immovable finger with 4 tubercles. Slight differences in tubercle counts on carpus and merus; however, the larger ones as described for holotype. See fig. 17, *b* for contours of annulus ventralis. The left chela of the allotype is abnormal, perhaps a regenerated one.

Morphotypic male, form II.—Differs from the holotype in the following respects: Cephalic section of telson with 2 spines in each caudolateral corner. Antennae extend caudad to third abdominal segment. Opposable margin of dactyl with 8 or 10 tubercles, one decidedly larger than the others in the same position as in holotype. Mesial margins of dactyls with 9 or 10 tubercles. Left dactyl with 6 tubercles in the row above mesial row. Opposable margin of immovable finger with 4 tubercles, the proximal 2 larger as in holotype. Slight differences in tubercle counts on carpus and merus; however, the larger ones as described for holotype. First pleopod differing from that of holotype in that there is less twist to the mesial process, and the central projec-

tion noncorneous and somewhat inflated. Hooks on ischiopodites of third pereiopods much reduced.

Measurements.—Holotype: Carapace height 12.9, width 13.4, length 26.8 mm.; areola width 0.0, length 10.7 mm.; rostrum width 3.8, length 4.9 mm.; abdomen length 25.5 mm.; left chela, length of inner margin of palm 5.7, width of palm 9.3, length of outer margin of hand 21.4, length of dactyl 15.2 mm. Allotype: Carapace height 13.4, width 13.9, length 29.0 mm.; areola width 0.0, length 11.5 mm.; rostrum width 4.4, length 5.2 mm.; abdomen length 28.5 mm.; right chela, length of inner margin of palm 5.7, width of palm 9.6, length of outer margin of hand 21.2, length of dactyl 15.7 mm.

Type locality.—Lower middle part of the Aransas National Wildlife Refuge, Aransas County, Texas. "The Aransas Refuge consists of some 47,000 acres on Blackjack Peninsula, which is bounded by several bays. This low land is fringed with brackish marsh. The gently rolling interior contains much oak brush, mainly live oak (*Quercus virginiana*) and myrtleleaf oak (*Q. myrtifolia*). Blackjack oak (*Q. marilandica*) is also common. Associated species are prickly ash (*Xanthoxylum clava-herculis*) and sweet bay (*Persea bordonia*). Interior grasslands contain swales or 'wet weather' ponds, dominated by little bluestem (*Andropogon scoparius*) and associated grasses of the genus *Paspalum*. These grasslands are dotted with groves or mottes of live oak. Areas around cattle tanks and some fresh water ponds are covered with Bermuda grass (*Cynodon dactylon*)." (Stevenson and Griffith, 1946, pp. 161–162.) Mr. Hedgpeth has informed me that the area in which the crayfish were taken from burrows "is often quite damp with runoff ponds, etc., and is separated from a salt marsh area by a low artificial dyke in the form of a road. At times in the spring the mud pillars are a conspicuous feature of the landscape."

Disposition of types.—The male, form I, holotype and second-form male morphotype (No. 85146) and the female allotype (No. 85147) are deposited in the United States National Museum. Paratypes, consisting of a first-form male and a female, are in my personal collection at the University of Virginia, H.H.H. No. 5–2147–1.

Specimens examined.—Texas: *Aransas County*, type locality, January 27, 1947, one male, form I, one male, form II, R. P. Allen, coll.; Aransas Refuge, McHoughs Well, May 21, 1947, one male, form I, one female J. W. Hedgpeth, coll.; Aransas Refuge, San Carlos Field, December 28, 1946, one female, R. P. Allen, coll. *Brazoria County*, Brazoria, one female, U.S.N.M. No. 17280, William Lloyd, coll. *Victoria County*, Victoria, one male, form I, U.S.N.M. No. 17279, William Lloyd, coll. Louisiana: *Orleans Parish*, New Orleans, one female, U.S.N.M. No. 2262, G. Kohn, coll. *DeSoto Parish*, Frierson,

one female, U.S.N.M. No. 23551, one male, form I, U.S.N.M. No. 23663, L. S. Frierson, coll.

Relationships—*Cambarus hedgpethi* has its closest affinities with *C. fodiens* and *C. byersi*. It is possible that further collecting between Indiana, Texas, and Alabama will show that intergrades occur among the three.

Variations.—Only slight variations were noted among the specimens I have examined. Regenerated chelipeds among them are markedly different from the normal ones; the opposable margins of the fingers bear no large tubercles, and the immovable finger is usually much broader at the base than are those of the normal chelae.

Remarks.—Faxon (1885, p. 77) recorded *Cambarus argillicola* (*C. fodiens*) from New Orleans, La., and Kinston, N. C., but stated that the specimens on which these records were based were immature and "cannot be determined with absolute certainty." Faxon (1898, p. 650) listed three localities for *C. argillicola*—two in Texas, Victoria and Brazoria, and one in Mississippi, Bay Saint Louis, Hancock County.

Ortmann (1905, p. 136) stated that "The localities, Kinston, N. Carolina, and New Orleans, Louisiana, given by Faxon in 1885 are doubtful, as admitted by himself. The localities given in 1898, Victoria and Brazoria, Texas (U. S. Mus.), most emphatically need confirmation."

Creaser (1932, p. 336), in summarizing the range of *C. fodiens*, stated with reference to the list of States from which this species had been taken (i. e., Michigan, Lower Ontario, Ohio, Indiana, Illinois, Mississippi, Louisiana, Texas, and North Carolina) : "The records for the four States last named are surely doubtful." With the description of *C. hedgpethi* Ortmann's and Creaser's doubts as to the occurrence of *C. fodiens* in Louisiana and Texas have been justified.

The specimens of *C. hedgpethi* I listed above from New Orleans, La., and Brazoria and Victoria Counties, Tex., are the same ones on which Faxon's records of *C. argillicola* were based.

I have also examined the specimen on which Faxon's Mississippi record was based (Bay St. Louis, Hancock County, 1 female, U.S.N.M. No. 17278) and find that this specimen belongs to *Cambarus byersi* Hobbs. While I have not seen the specimen(s) from Kinston, Lenoir County, N. C., I feel certain that *C. fodiens* does not occur in North Carolina. Perhaps the specimen(s) in question belong(s) to the somewhat closely related *Cambarus uhleri* Faxon (1884, p. 116).

The known range of *Cambarus fodiens* extends from Ontario through Ohio, Michigan, Indiana, and Illinois. Creaser (1932, p. 336) pointed out that a search should be made in southern Wisconsin for this species, and it seems probable in the light of the following that

the whole Mississippi Valley and adjoining regions should be combed for this or closely related species.

There are two specimens (a first-form male and a female) in the collection of the U. S. National Museum, U.S.N.M. No. 62312, from a spring at Imboden, Lawrence County, Ark., collected by Byron C. Marshall. In most respects these specimens are typical *fodiens;* however, the first pleopod of the male shows two rather striking variations. The cephalic surface of the appendage is more convex than it is in typical specimens, and there is a distinct angular prominence on the cephalomesial surface of the appendage just cephaloproximad of the base of the "funnel." The central projection also shows a slight variation from that of typical *fodiens.* Whether these peculiarities are individual variations can be determined only after a series of specimens has been collected in this region.

Engle (1926, p. 93) stated that he had seen a number of specimens of *C. argillicola* from ponds near the State fair grounds, Lincoln, Lancaster County, Nebr. This locality should be confirmed.

It should be noted that in the list of synonymy above, the reference to Lyle, 1938, is preceded by a question. Since he merely lists *Cambarus argillicola* (= *C. fodiens*) from Mississippi, I do not know whether he is referring to the Faxon record (in which case it would fall into the synonymy of *C. byersi*) or whether he actually has additional specimens. In either case (unless his specimens came from the northeastern part of the State, and should prove to be typical *fodiens*) I do not believe this record should be accepted without further confirmation.

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